

REMARKS

Claims 1-10 are all the claims pending in the application. Claims 1, 2 and 5-7 are rejected. Claims 3, 4 and 8-10 are withdrawn from consideration. Applicant has amended claims 1, 2, 5 and 6. Claim 7 has been cancelled. New claims 11-22, which depend directly or indirectly from amended claims 1 or 2, have been added.

With respect to the amendments made, the following support in the original specification exists:

Claim 1: The limitation to "said spacer layer having a thickness of 1.2 nm or less" is based on the description of page 11, lines 11-12 from the bottom of the instant specification.

The limitation to "said exchange coupling film causing antiferromagnetic coupling such that said first magnetic layer has a magnetization direction antiparallel to that of said second magnetic layer" is based on original claim 7 and on the description of page 14, lines 13-14.

Claim 2: The limitation to "said exchange coupling film causing antiferromagnetic coupling such that said first magnetic layer has a magnetization direction antiparallel to that of said second magnetic layer" is based on original claim 7 and on the description of page 14, lines 13-14.

The limitation to "said principal surface of the spacer layer having a surface roughness Ra which is not greater than a thickness of said spacer layer and is not greater than 0.5 nm" is based on the description of page 10, lines 9-12.

Claim 6: The amendment is based on the description of page 21, lines 3-5 from the bottom and on the description of page 22, lines 10-12.

Claim 11: The limitations are based on the description of page 13, lines 7-8.

Claim 12: The limitations are based on the description of page 11, last line through page 12, line 5.

Claim 13: The limitations are based on the description of page 11, lines 6-9.

Claim 14: The limitations are based on the description “the third magnetic layer as a magnetic recording layer” of page 12, lines 5-6 and on the description “magnetic grains forming the magnetic recording layer preferably have an average grain size of 10 nm or less” of page 12, lines 10-11.

Claim 15: The limitations are based on the description “the second magnetic layer may be used as a magnetic recording layer” of page 11, lines 2-3 and on the description “magnetic grains forming the magnetic recording layer preferably have an average grain size of 10 nm or less” of page 12, lines 10-11.

Claims 16, 17, and 18: The limitations are similar to the amended claims 5 and 6 and the new claim 11, respectively.

Claims 19-22: The limitations are similar to the new claims 12-15, respectively.

Election/Restriction

The Examiner has treated Applicants’ election and argument as an election without traverse. The Requirement for election has been made final. Claims 3, 4 and 8-10 are withdrawn from consideration on the basis of the election. Applicant will cancel these claims upon an indication of allowability of the examined claims. In any event, Applicants reserve the right to file a divisional application in accordance with the provisions of 35 USC 121.

Specification

The Examiner objects to the title because the Examiner finds it not to be sufficiently indicative of the invention to which the claims are directed. The Examiner suggests a new title and Applicants agree with the suggestion.

Claim Rejections – 35 USC 112

Claims 1, 5-7 are rejected under 35 USC 112, first paragraph a not being enabling. The Examiner makes the rejection “because the specification, while being enabling for a surface roughness of the spacer layer being not greater than a thickness of said spacer *and also not greater than 1.2nm*, does not reasonably provide enablement for producing an exchange coupling structure possessing a ‘first’ and ‘second’ magnetic layer separated by a spacer layer of any

thickness, wherein the surface roughness is less than the thickness of the spacer layer.” In short, the Examiner does not find the specification enabling, as he asserts that the only working exchange coupling structures disclosed are those which possess a spacer layer having a thickness of 1.2 nm or less.

This basis for rejection is rendered moot by the addition of a thickness limitation for the spacer layer in the claims.

Double Patenting

The Examiner has rejected claims 1, 2 and 5-7 under the judicially created doctrine of obviousness type double patenting as being unpatentable over claims 1-12 of USP 6,759,138. This rejection is traversed for at least the following reasons.

U.S. Patent No. 6,759,138B2 (Tomiyasu et al) does not disclose or claim, as now recited in amended claims 1 and 2, that the principal surface of the spacer layer has a surface roughness Ra which is not greater than the thickness of the spacer layer. Such feature would not be obvious.

Claim Rejections – 35 USC 102

Claims 1, 2 and 5-7 are rejected under 35 USC 102(e) as being anticipated by Tomiyasu et al (6,759,138). This rejection is traversed for at least the following reasons.

As regards the amended claims 1 and 2, the principal surface of the spacer layer has a surface roughness Ra which is not greater than the thickness of the spacer layer. The original disclosure in the specification states at page 9, line 9 from the bottom through page 10, line 1 that:

“It is supposed that, if the surface roughness of the principal surface (or the upper surface) of the spacer layer is large, for example, relative to the thickness of the spacer layer, the distance between the first and the second magnetic layers is varied depending upon the irregularities of the spacer layer in the microscopic region so that the variation in exchange coupling is caused. Therefore, it is supposed that the variation in exchange coupling can be suppressed if the surface roughness Ra of the spacer layer is not greater than the thickness of the spacer

layer. As a consequence, excellent thermal fluctuation resistance can be obtained.”.

Thus, this invention has a feature characterized in that “the principal surface of the spacer layer has a surface roughness Ra which is not greater than the thickness of the spacer layer”. This feature can suppress the variation in exchange coupling and can therefore obtain excellent thermal fluctuation resistance.

U.S. Patent No. 6,759,138B2 (Tomiyasu et al) neither discloses nor suggests, as now recited in amended claims 1 and 2, that the principal surface of the spacer layer has a surface roughness Ra which is not greater than the thickness of the spacer layer, which also is specified..

Claims 1, 2 and 5-7 are rejected under 35 USC 102(e) as being anticipated by Tomiyasu et al (2003/0104248). This rejection is traversed for at least the following reasons.

U.S. Patent App. No. 2003/0104248A1 (Tomiyasu et al) neither discloses nor suggests, as now recited in amended independent claims 1 and 2, that the principal surface of the spacer layer has a surface roughness Ra which is not greater than the thickness of the spacer layer, which also is specified.

Claims 1, 2 and 5-7 are rejected under 35 USC 102(f) on the basis of the disclosure in Tomiyasu et al (6,759,138). The Examiner asserts that the difference in identified inventive entity suggests that Applicants did not invent the claimed subject matter. This rejection is traversed for at least the following reasons.

As already noted, the presently claimed subject matter, specifically, that the principal surface of the spacer layer has a surface roughness Ra which is not greater than the thickness of the spacer layer, which also is specified, is not taught in Tomiyasu et al.

Claims 1, 2, 5 and 6 are rejected under 35 USC 102(e) as being anticipated by Kikitsu et al (2005/0041335). This rejection is traversed for at least the following reasons.

Kikitsu et al neither discloses nor suggests, as recited in amended claims 1 and 2, that the principal surface of the spacer layer has a surface roughness Ra not greater than the thickness of

the spacer layer in the exchange coupling film. As previously noted, this feature is taught at pages 9 and 10 of the present application.

Also, Kikitsu et al does not teach or suggest the limitation added to both of independent claims 1 and 2 that "said exchange coupling film causing antiferromagnetic coupling such that said first magnetic layer has a magnetization direction antiparallel to that of said second magnetic layer." This feature is clearly explained in the specification at page 11, lines 11-12 from the bottom, and at page 14, lines 13-14.

The absence of such antiferromagnetic coupling feature in Kikitsu et al is admitted by the Examiner, as it was expressly claimed in claim 7, but that claim was not rejected as anticipated by Kikitsu et al. The Examiner also expressly states at page 9 of the Office Action that Kikitsu fails to disclose the surface roughness of the Ru spacer layer.

Claim Rejections – 35 USC 103

Claims 1, 2 and 5-7 are rejected under 35 USC 103 as being unpatentable over Kikitsu et al in view of Fukuzawa et al (2005/0030676). This rejection is traversed for at least the following reasons.

Kikitsu et al

Kikitsu et al discloses a magnetic recording medium in which a recording layer and a functional layer exert exchange coupling interaction in a direction making a substantially orthogonal relation with each other (see Abstract and claim 1). The Examiner admits that Kikitsu et al fails to disclose the surface roughness of the Ru spacer layer. The Examiner looks to Fukuzawa et al for a teaching that in synthetic antiferromagnetic structure, a surface roughness of the spacer layer may be less than the thickness of the layer in order to maintain the thermal stability of the coupling function of the layer as disclosed at [0309]-[0314].

Fukuzawa et al

Fukuzawa et al discloses a magnetoresistance effect device (MR device) in which bias point designing is easy, and also a magnetic head, a magnetic head assembly and a magnetic recording/reproducing system may be incorporated with the MR device (see Abstract). Fukuzawa et al disclose use of the antiferromagnetic coupling function.

The Examiner admits that Fukuzawa et al is directed to a magnetic head, and admits that Kikitsu et al is directed to a magnetic recording medium. The differences between these two structures in operation, effect and requirements is significant and apparently acknowledged by the Examiner. Nonetheless, the Examiner asserts that one of ordinary skill in the art would appreciate that synthetic antiferromagnetic structures are used in both related fields and asserts that it would have been obvious to turn to either field for a teachings of improvements related to synthetic antiferromagnetic structures.

To the contrary, the Examiner appears to have engaged in impermissible hindsight in combining these two references. Fukuzawa et al discloses a recording device, which records information into a magnetic recording medium, while Kikitsu et al disclose a magnetic recording medium. Importantly, there is no teaching or suggestion in either Kikitsu et al and Fukuzawa et al that one would look to a recording device as in Fukuzawa et al to modify a magnetic recording medium as in Kikitsu et al. Because of the significant differences in application and structure, there is a prima facie presumption that one would not look so far afield. Moreover, even if one would look to Fukuzawa as a related art, the modification of Kikitsu et al to use a spacer layer meeting the claimed surface roughness in order to maintain thermal stability of the coupling function of the layer, as this would itself involve inventive activity.

Finally, the two references would not render obvious the presently recited combination of structures, including the newly added requirement that the exchange coupling film causes antiferromagnetic coupling such that said first magnetic layer has a magnetization direction antiparallel to that of said second magnetic layer. This feature appeared in claim 7, which was not anticipated by Kikitsu et al. The Examiner's reference to the disclosure at paragraphs 0077 and 0290 are unavailing as the claim combination is to (1) a principal surface of the spacer layer having a surface roughness Ra not greater than the thickness of the spacer layer in the exchange coupling film and (2) an exchange coupling film causing antiferromagnetic coupling (3) such that the first magnetic layer has a magnetization direction antiparallel to that of the second magnetic layer. Nothing in Kikitsu et al taken alone or in combination would teach these three interrelated limitations in a magnetic disk.

Amendment Under 37 C.F.R. § 1.111
U.S. Application No. 10/762,574

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

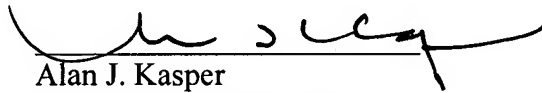
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